STUDENT LEARNING STYLE PREFERENCES AND PERFORMANCE ON STANDARDIZED ACHIEVEMENT TESTS

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by

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An Abstract of a Field Report by
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The problem. The problem of this study was to determine the relationship between assessed student learning style preferences and performance on standardized tests of achievement.

Procedure. The Learning Style Inventory and the Iowa Tests of Educational Development were administered to ninth and eleventh grade students at Titonka Consolidated School. A Pearson product-moment correlation was computed for sixteen selected pairs of learning style preference and standardized achievement test variables.

Conclusions. There were, according to table values, significant positive relationships between (1) student auditory learning style preference and standardized achievement testing in Reading, (2) student auditory learning style preference and standardized achievement testing in Correctness of Expression, and (3) student visual learning style preference and standardized achievement testing in Reading. There was, according to table values, a significant negative relationship between (1) student tactile learning style preference and standardized achievement testing in Correctness of Expression.

Recommendations. (1) School administration and faculty should continue to assess student learning styles and use in-service to provide insight and understanding of learning style, (2) this study should be replicated and expanded at Titonka Consolidated School, (3) this study should be replicated at other school districts, (4) school administration and faculty should be involved in the processes of diagnosis, prescription and evaluation of student learning style preferences and achievement, (5) school administration and faculty should work toward a more flexible student learning environment, (6) school administration and faculty should concentrate on better student advisement and guidance, and (7) educators should keep an open mind and be wary of generalizations in the area of student learning style.

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CHAPTER 1

Introduction

The human is capable of learning anything, under the appropriate environmental conditions. Education and the schools of the 1980s are focusing in on "basic skills" and educational accountability as their primary objectives toward excellence. Educators have tended to view instruction and learning as direct correlates. If the one is present to an acceptable degree, the other should naturally follow. If the teacher is working hard, students should be learning.

Both intellectual and nonintellectual factors are involved in academic performance. Neither is easily evaluated, but both strongly influence behavior. The more one can reliably know about each, the better will be one's ability to predict and assess.

Achievement tests were designed to measure students' present knowledge and skills. How an individual student learns is perhaps the most important factor related to academic achievement, but relatively few instruments have been published that attempt to assess those elements that extend beyond achievement and ability.

Learning style describes an individual student in terms of educational conditions under which learning is most likely to occur. Learning style identifies how students perfer to learn, not why they learn or what they have learned. There are those individual students who achieve only through particular methods and strategies - the same methods and strategies which might very often fail to produce academic results for other individual students.

A learning style should not be value labeled as good or bad or better or worse but should be considered in terms of its usefulness for an individual student and in a particular situation.

In guidance, assessment - with or without testing - is carried out to help the individual student gain self-understanding, make plans, and make decisions. Data about achievement, abilities, interests, and learning style preferences facilitate these student tasks. In the area of guidance and counseling, the philosophy is for individual students to be responsible for their own use of test information and to be the decision makers. It is the responsibility of the counselor, therefore, to provide complete, comprehensive, and honest feedback to the student on his/her assessed characteristics and performances. To be able to do this, the counselor must have the necessary training and understanding of tests' contents, relationships and interpretations.

This study explored the relationship between assessed learning styles and standardized achievement tests results.

Statement of the Problem

The problem of this study was to determine the relationship between assessed learning style preferences and performance on standardized tests of achievement, as derived from the Learning Styles Inventory (LSI) and the Iowa Tests of Educational Development (ITED).

Purpose of the Study

It was the purpose of this study to provide for educators an insight toward the possible relationships between a limited number of students' assessed learning style preferences and performance on standardized

achievement tests. This information can then be used for better decision making, interpretations and assessment.

Identification of the Variables Studied

There were two variables studied. These were the:

1. Learning Styles Inventory standard score, and the
2. Iowa Tests of Educational Development standard score.

From the Learning Styles Inventory, there were four category variables selected. These were:

1. Auditory
2. Visual
3. Tactile
4. Kinesthetic

From the Iowa Tests of Educational Development, there were four category variables selected. These were:

1. Correctness and Appropriateness of Expression
2. Quantitative Thinking
3. General Vocabulary
4. Reading Total

Definitions of Terms

Learning style was defined as the way individuals concentrate on, absorb, and retain new or difficult information or skills.

An achievement test was used to measure an individual's present level of knowledge or skills or performance.

A standard score was a derived score with a mean of 0 and a standard deviation of 1.

Identification of Internal and External Threats to Validity

To establish the internal validity of the study, it was necessary to rule out possible threats which could produce an impact on the outcome variable. There were eight classes of variables to be considered as threats to internal validity.

For this particular study, the variables of contemporary history and differential selection of subjects were not applicable since there was no treatment to be concerned with between testings. There was no pretest to pose a threat to the internal validity, and students were not forewarned about the Learning Style Inventory. It was the policy of Titonka High School not to teach to the standardized achievement tests.

The possible threats from statistical regression and interaction of selection were not relevant for this study since all students who met the sampling criteria were included in the study; there were no volunteers.

Maturation was not a serious problem since the pattern of testing for this study was not out of the ordinary, expected by the students, and the test scores were grade and/or age normed.

The problem of differential mortality was not a problem since again, no sample groups were being used.

Assumptions

It was assumed by this study that all students included in the sample did their best when answering questions on the ITED. It was also assumed that these same students reported their natural preferred means of learning on the LSI.

Limitations

This study concerned itself with only four learning style variables. It was, by no means, meant to be a study of all learning style variables. The Learning Style Inventory (LSI) defined learning styles in terms of conditions which the teacher can alter or adjust to complement the needs of a particular individual.

The LSI did not address some of the elements of learning style such as: analytic or global; high or low conceptual level; field independent or dependent; reflective or impulsive; concrete, abstract, random or sequential; risk taking or cautious; and brain hemispheric dominance.[1] This did not undercut their importance. The Dunns sensed the valuable information which one could gather from a study of the psychological elements and hope to incorporate them into their learning style model, realizing that extensive field studies must be undertaken before a precise understanding is arrived at concerning how these psychological elements affect schooling.

There are undoubtedly many more learning style variables yet to be discovered. Studies are being conducted to see if weather and color should be included as environmental elements of learning style. It is anyone's guess as to how many learning style variables will be identified and tested in the next one hundred years.

This does not mean education and schools should sit back and wait. The learning style diagnosis which was available gives educators a rational base from which to structure the educational environment. "It gives the

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[1]Rita Dunn, Kenneth Dunn, and Gary E. Price, Learning Style Inventory Manual (Lawrence, KS: Price Systems, 1981), pp. 1-2.

most powerful leverage yet available to education to analyze, motivate, and assist students in school."[1]

The results of this study applied only to Titonka Consolidated School. However, it was felt that similar results may exist in other schools where the educational program is not a by-product of a study of the twenty-four learning style variables assessed by the Learning Style Inventory.

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[1] James Keefe, "School Applications of the Learning Style Concept," Student Learning Styles: Diagnosing and Prescribing Programs (Reston, VA: National Association for Secondary School Principals, 1979), p. 132.

CHAPTER 2

Review of Literature

Education research has classically focused on learning theory, learner performance, and learner characteristics. Learner characteristics and learner performance may be addressed through the concept of student learning style.

Learning styles are characteristic cognitive, affective and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. It is based on the notion that teaching to the strengths of students enhances their ability to learn. If the desire of all educators is to have the majority of students achieve to their potential, attention to individual learning styles seems crucial.[1]

Every student has a learning style, regardless of cognitive ability or achievement. Psychobiologists have identified which elements of style are biological and which develop as an outgrowth of life experiences.[2] Despite that knowledge, it is difficult to identify a student's style accurately merely by observation because (a) different elements affect different individuals with varying intensity, (b) motivation can overcome an element if it is no stronger than a preference, and (c) elements may change

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[1] James W. Keefe, "Learning Style: An Overview," in Student Learning Styles, p. 4.

[2] James W. Keefe, "Learning Style: An Overview," in Student Learning Styles, p. 4., citing Restak (1979), Thies (1979).

over time.[1]

Dunn, Dunn, and Price have stated that how a student learns is perhaps the most important factor related to his/her academic achievement. Indeed, Dunn and Dunn cited data concerning elementary school students in the Westorchard School (Chappaqua, New York) clearly indicating that openness, informality, and individualization can contribute to superior achievement as measured by standardized tests in reading and mathematics. By teaching the basics (reading and math) in ways that respond to individual students' learning styles and interests, the Westorchard teachers were able to reverse in one year a trend of dropping standardized test scores over the previous years. Similarly, Reinert stated that the diversity of learning styles appears to be so much greater than has generally been recognized that many slow learners may be "slow" only because they have never had a chance to learn in their preferred way.[2]

Examination of the literature regarding the elements that presumably constitute learning styles revealed disagreement and inconclusiveness among educators, psychologists, and researchers. Could knowledge of students' learning styles be used to make decisions about what students should learn and which methods would most effectively accomplish the desired outcomes?

A major problem of studies of this topic was that most of the early research was spent looking for the one perceptual mode that would best induce learning and retention.

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[1] Keefe, "Learning Style: An Overview," in Student Learning Styles, pp. 4-5, citing Copenhaver (1979), Price (1980).

[2] Richard P. Holland, "Learner Characteristics and Learner Performance: Implications for Instructional Placement Decisions," The Journal of Special Education, 16, No. 1 (1982), p. 7, citing Reinert (1976).

It became quite clear that no one teaching method or program of instruction could respond sensitively to every learning style or to every student. In the 1960s, and the early 1970s, an emphasis was placed on individualizing instruction. This was evident in numerous innovations concerning the learning environment: such as, the NASSP Model School's Project (MSP), Project PLAN (Program for Learning in Accordance with Needs), and Individually Guided Education (IGE).

Specific methods or programs in and by themselves were neither good nor bad. The fact was that certain programs were very appropriate and others were just not suited for a given student. The logical conclusion was that if a student was placed in the wrong program for him/her, his/her ability to progress academically would be greatly impeded.[1] Reissman supported this concept and stated, "Children may not be learning because the methods of learning are not suited to their style and hence they cannot best use their mental power."[2]

Opinions differed concerning the educational approach one should take once a student's learning style was identified. "Kagan and Krathwahl found that students could be trained to use another style of learning."[3] Gregorc, Ramiez and Castanedo and others advocated selective teaching of students through their weaker characteristics to build upon those.[4]

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[1] Rita Dunn and Kenneth Dunn, "Using Learning Style Data to Develop Student Prescriptions," in Student Learning Styles, p. 110.

[2] Frank Reissman, "Students' Learning Styles: How to Determine, Strengthen, and Capitalize on Them," Today's Education, 65, No 3 (1976), p. 94-98.

[3] R. W. Copenhaver, "The Consistency of Learning Styles," The Teacher Educator, 15, No. 3 (1979-1980), p. 5.

[4] Rita Dunn and Others, "Learning Style Researchers Define Differences Differently," Educational Leadership, 38, No. 5 (1981), p. 373.

Dunn and Dunn stated, "Although it may be possible to teach students to become more effective learners through specific learning strategies, the outcomes are more likely to be positive if we teach them through their individual learning style characteristics."[1]

Whether the emphasis was on helping students to be better able to benefit from information acquired through a wider variety of learning style variables or in accord with the Dunns' philosophy of always teaching through strengths, a necessary prerequisite was the identification of student learning styles. A purposeful program of instruction could then be implemented which developed rationally from the knowledge of the student learning styles for whom the instruction was intended.

Several research studies supported the concept that when the students were taught through their preferred learning style, they tended to achieve more than when they were not.[2] In addition to increased academic achievement, "when a student learned in ways that were natural for him, the outcomes usually were...improved self-esteem..., a liking for learning..., improved basic skills..., stimulated creativity, and gradually increasing learner independence.[3]

Differences in learning styles existed within ability groups. After studying learning styles and ability groups, Marcus concluded, "many dif-

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[1]Dunn and Dunn, "Using Learning Style Data to Develop Student Prescriptions," in Student Learning Styles, p. 111.

[2]Dunn and Dunn, "Using Learning Style Data to Develop Student Prescriptions," in Student Learning Styles, p. 111, citing Domino (1970), Martin (1977), Douglass (1979), Trautman (1979), Cafferty (1980), Carbo (1980).

[3]Dunn and Dunn, "Using Learning Style Data to Develop Student Prescriptions," in Student Learning Styles, p. 111.

ferences in learning styles among these groups could be noted. What was also apparent was that in none of the groups studied could unanimity be found on any one element of learning style.[1]

A brief comparison of researchers in the field of learning style, which listed their definitions of learning style, the instrument used to assess learning style, and a comment concerning the application of each was presented in the February, 1981 issue of Educational Leadership.[2] David Hunt stated that "the differences among the various learning style models may be less important than the general effect of describing students in terms of matches or person environment combinations."[3] Gregorc commented that mental health and self-understanding would improve as well as learning increase as more was understood about learning and teaching styles.[4]

The Learning Style Inventory (LSI) by Dunn, Dunn, and Price, 1978, was chosen by this author for the following reasons: it had established reliability and validity; its terminology was understandable by teachers, students, and parents without the need to go through technical definitions; it was easy to administer; and the authors made practical suggestions concerning how to adapt the learning environment to accommodate various learning styles.

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[1]Lee Marcus, "Learning Style and Ability Grouping Among Seventh Grade Students," Clearing House, 52, No. 8 (1977), p. 380.

[2]Dunn and Others, "Learning Style Researchers Define Differences Differently," pp. 374-75.

[3]David E. Hunt, "Learning Style and the Interdependence of Practice and Theory," Phi Delta Kappan, 62, No. 9 (1981), p. 647.

[4]Anthony F. Gregorc, "Learning/Teaching Styles: Potent Forces Behind Them," Educational Leadership, 36, No. 4 (1979), p. 236.

The results of a two-year study conducted at Ohio State University's National Center for Research in Vocational Education of instruments that identify learning styles concluded that Dunn, Dunn, and Price's Learning Style Inventory (LSI) had "established impressive reliability and face and construct validity."[1]

The LSI helped in the diagnosis of environmental, emotional, sociological, and physical conditions under which an individual was most likely to learn, achieve, create, or solve problems. It yielded information concerned with the patterns through which a student perceived he/she learned best - not why they existed nor the skills which the student possessed.[2] Dunn, Dunn, and Price stated that "the findings of several well designed and carefully conducted studies verify that students are capable of accurately indicating the ways in which they will achieve best."[3]

The history of the LSI began in 1967 when the New York State Education Department asked Rita Dunn to direct a graduate program designed to develop teachers who would be capable of helping students learn who had not responded well to traditional instruction. Over a three year period, approximately 600 students preparing to be teachers, eight college professors, more than twenty classroom teachers, and five administrators worked together to develop innovative instructional strategies.

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[1]Patricia Kirby, Cognitive Style, Learning Style, and Transfer Skill Acquisition (Columbus, OH: The Ohio State University National Center for Research in Vocational Education, 1979), pp. 71-74.

[2]Dunn, Dunn, and Price, Learning Style Inventory Manual, pp. 1-2.

[3]Rita Dunn, Kenneth Dunn, and Gary E. Price, "Learning Styles: Research Vs. Opinion," Phi Delta Kappan, 62, No 9 (1981), p. 645, citing Domino (1970), Farr (1971), Robertson (1977), Cafferty (1980).

"What became apparent was that selected methods appeared to be extremely effective with some youngsters but failed to produce anything other than minor gains with others."[1] This led to the conclusion that if "we were to help students become academically successful, we had to develop different methods and then in some way determine which might appeal to and be effective with selected learners.[2]

"The LSI was a result of fourteen years of school - and university-based research involving more than 20,000 students..."[3] Dunn, Dunn, and Price identified variables from research that seemed to affect the way individuals prefer to learn.[4] The LSI was developed after conducting a content analysis of each of approximately 360 questionnaire items and isolating those that achieved a 90 percent consistency. The 1978 LSI, which was used for this study, was a result of a careful review of each item in the 1975 LSI. "The analysis included a determination of the items that were confusing, could be interpreted in different ways and were not clear in their assessment of the defined areas."[5]

The Dunns' learning style model conceptualized student learning styles into twenty-one different elements arrayed in five major stimuli. Environmental stimuli included the elements of sound, light, temperature and design. Emotional stimuli included the elements of motivation, persistence,

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[1]Rita Dunn, Kenneth Dunn, and Gary Price, "Identifying Individual Learning Styles," in Student Learning Styles, p. 39.

[2]Dunn, Dunn, and Price, "Identifying Individual Learning Styles," in Student Learning Styles, p. 40.

[3]Rita Dunn, Kenneth Dunn, and Gary E. Price, "Learning Styles: Research Vs. Opinion," p. 645.

[4]Dunn, Dunn, and Price,"Learning Styles: Research Vs. Opinion, p. 646.

[5]Dunn, Dunn, and Price, Learning Style Inventory Manual, P. 14.

responsibility, and structure. Sociological stimuli included the elements of peers/self, pair/team, adult, and various combinations. Physical stimuli included the elements of perception (auditory, visual, tactual, and kinesthetic), intake, time, and mobility. Psychological stimuli included the elements of analytic/global, field (dependent and independent), and hemispheric preference.

Of the 21 factors, the most important related to the amount and kind of structure needed, the sociological factors, perceptual strengths, and time of day.

The perceptual strengths of auditory, visual, tactile, and kinesthetic learning preferences were included by Dunn and Dunn in the physical elements of learning styles. Both the environmental and physical elements of learning style were biological; they were genetically imposed by nature. They did vary at different stages of life, but the rate at which they develop a change was related directly to the individual's maturation and physical condition.

It had been estimated that ninety percent of all instruction occurred through the lecture and the question and answer methods, and yet, only between two and four students in each group of ten learned best by listening.[1]

Years ago the research data tended to be confusing because studies frequently were undertaken to determine whether students learned better by listening or by seeing. Since a choice between the two senses was the only choice, findings tended to verify that either one or the other was superior.

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[1]Rita Dunn and Kenneth Dunn, Educator's Self-Teaching Guide to Individualizing Instructional Programs (West Nyack, NY: Parker Publishing Company, 1975), p. 13.

Prior to the 1960s, researchers did not examine individual youngsters to identify whether each learned better or less well through methods and materials that taught them either through their auditory or visual perceptions. Nor were investigators aware that some people learned by touching (tactual) and that others required experiential or whole body (kinesthetic) experiences in order to learn and to retain what was learned. Further, some youngsters learned best through a combination of two or more senses.[1]

An auditory learner could remember approximately 75% of what was discussed in a forty or fifty minute lecture or discussion. When children enter kindergarten, very few can remember such a high percentage. Most do not become auditory before fifth or sixth grade; and girls become auditory learners earlier than boys.[2]

Students who learned through their auditory sense could differentiate among sounds and could reproduce symbols, letters, or words by hearing them. Such students should be taught through a phonics approach.[3]

A visual learner could remember approximately 75% of what he or she has read or seen during a forty to fifty minute session. More people are visual than auditory in style. Research evidenced that approximately 40% of the school-age population was visual; however, most children were not visual until third or fourth grade.[4]

Students who learned through their visual sense could associate shapes

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[1]Dunn and Dunn, Educator's Self-Teaching Guide to Individualizing Instructional Programs, p. 13.

[2]Dunn, Dunn, and Price, "Identifying Individual Learning Styles," in Student Learning Styles, p. 49, citing Restak (1979).

[3]Dunn, Dunn, and Price, "Identifying Individual Learning Styles," in Student Learning Styles, p. 50.

[4]Dunn and Dunn, Educator's Self-Teaching Guide to Individualizing Instructional Programs, p. 13, citing Price (1980).

and words and conjure up the image of a form by seeing it in their mind's eye. Such students could learn through a word-recognition approach.[1]

Youngsters who learned through their tactual sense could not begin to associate word formations and meanings without involving a sense of touch.[2]

Youngsters who learned through their kinesthetic sense needed to have real-life experiences in order to learn to recognize words and their meanings.[3]

Most kindergarten students were essentially tactile and kinesthetic in style; they found it easiest to learn by manipulating resources and actually experiencing through activities. Price's study of 3,972 subjects in grades three through seven verified that the younger the child, the more tactile and kinesthetic he or she was. Keefe also reported that "Perceptual preference seems to evolve for most students from psychomotor (tactile and kinesthetic) to visual and aural as the learner 'matures.'" Research verified repeatedly that when new information was introduced through the strongest perceptual strength, reinforced through the second, and used creatively, statistically significant increases occurred in academic achievement.[4]

Testing is very much a part of the contemporary education scene. It begins during (or before) the earliest years of schooling and continues

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[1]Walter B. Barbe and Raymond H. Swassing, Teaching Through Modality Strengths: Concepts and Practices (New York: Zane-Bloser, Inc., 1979).

[2]Rita Dunn and Kenneth Dunn, Teaching Students Through Their Individual Learning Styles: A Practical Approach (Reston, VA: Reston Publishing Company, 1978), p. 50.

[3]Dunn and Dunn, Teaching Students Through Their Individual Learning Styles: A Practical Approach, p. 51.

[4]Barbe and Swassing, Teaching Through Modality Strengths: Concepts and Practices, citing Carbo (1980), Urbscht (1977), Wheeler (1980).

until the individual finally takes leave of the schools. The roles of testing in the United States' educational system are not static and routine; educationists and measurement specialists are constantly searching for new and better ways to use test results, for alternative approaches to measuring pupil performance, and for ways in which tests may be used to meet the challenging demands society makes of the schools.

Tests were invented to do particular jobs. Some have the characteristics to do their intended jobs exceedingly well, others do not. Some are used intelligently and therefore can be very valuable; some are used unwisely and can be detrimental. The scientifically unexamined test is not worth having. Perhaps there has been a tendency to exalt the test score - to use test scores in isolation from other information - which is almost always limiting and inadvisable.

The Iowa Tests of Educational Development were measures of abilities that were important in adolescent and adult life and that constitute a major part of the foundation for continued learning. These skills included the ability to recognize the essentials of good writing, to solve quantitative problems, to analyze discussions of social issues critically, to understand nontechnical scientific reports and recognize sound methods of scientific inquiry, to perceive the subtle meanings and moods of literary materials, and to use sources of information and common tools of learning.[1]

The ITED were achievement tests in a broad sense. They were designed to measure how well students could apply what they have learned in new

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[1] Manual for Administrators and Testing Directors (Iowa City: The University of Iowa, 1980), p. 1.

settings. Thus, the students were required to apply their knowledge and skills in analyzing materials that they probably had not seen before. Clearly, the level of student performance on the tests reflected in large measure the effects of school experiences, for these experiences were designed to promote intellectual growth. The test scores also showed evidence of educational development that stemmed from out-of-school experiences and activities.[1]

The tests' authors did not claim that the ITED measured all the worthwhile objectives of secondary education. The ITED did, however, present a carefully selected sample of tasks demanding the use of many important skills, skills that practically all adults must use in daily life. Therefore, the tests' authors believed the tests appropriate for virtually all high school students, regardless of the particular courses they were taking or the curriculum they were following. Although each student had many unique needs and objectives, all students had many needs in common. These included the need to exercise the rights and responsibilities of citizenship, the need to manage money effectively, and the need to find and use information from a variety of sources.[2]

Assessing the long-range objectives and goals of education is a difficult task. Standardized tests serve their most valuable function when they concentrate on assessing the extent to which students are achieving the long-range educational goals toward which the various methods and materials converge.

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[1] Manual for Administrators and Testing Directors, p. 2.

[2] Manual for Administrators and Testing Directors (Iowa City: The University of Iowa, 1980), p. 1.

CHAPTER 3

Methods and Procedures

In order to explore the relationship between assessed learning style preference and performance on standardized achievement and ability tests, it was necessary to administer the Learning Styles Inventory (LSI), and the Iowa Tests of Educational Development (ITED) to a sample group of students.

For the purpose of this study, all students at Titonka Consolidated School who had taken the Iowa Tests of Educational Development in September 1984 and the Learning Style Inventory in November 1984 were included in the sample. Only those students that took both of the testing instruments at the scheduled times and at Titonka Consolidated School were included in the study.

The LSI was a 104-item questionnaire. Each item required a response of Strongly Agree, Agree, Indifferent, Disagree, or Strongly Disagree. Individuals were encouraged to give their immediate reaction to each question. It had been suggested by practitioners, including David Cavanaugh, former principal of Worthington High School, Worthington, Ohio, that a follow-up interview, after the LSI had been scored, be conducted with the student and/or parents to help validate the individual's preferred learning style.

The LSI was computer scored. A student received a standard score on each of twenty-two learning styles variables. The standard scores had a mean of fifty and a standard deviation of ten. A standard score of sixty or above indicated a variable which a student strongly preferred or saw oneself as when one learned. A score of forty or below indicated the

individual definitely did not prefer that factor when one studied. A score between forty and sixty on any variable indicated that the variable under question was not greatly desired nor actively avoided when one studied. The manual listed for each variable recommendations for teachers to use with students who had standard scores of sixty or above and forty or below.

The writer administered the Learning Styles Inventory during the week of November 5, 1984, in the 9th and 11th grade English classes at Titonka Consolidated School, Titonka, Iowa. The 104-question inventory was read to the students. Each student also had a copy to read. Students were told to give immediate reactions to each question according to how one personally felt. The LSI took approximately thirty minutes and was given in one setting.

As one of the two checks for consistency, each student had a conference with the writer to review the results of the LSI. In accordance with recommendations of the LSI authors, if the student felt the results did not accurately represent his/her learning style, the student was given the opportunity to retake the LSI. Students who did not wish to retake the LSI and who felt the results were inaccurate would be dropped from the study. All students of this study felt the LSI results were accurate.

In accordance with the instructions in the Learning Style Inventory Manual and providing the main consistency check, answer sheets which received a consistency score of .70 or lower were considered invalid and were not to be used in the statistical analysis. All student answer sheets used in this study received consistency scores of .71 or above.

The Seventh Edition of the Iowa Tests of Educational Development was the product of almost forty years' experience in the construction and use

of standardized achievement tests. This edition included separate tests in seven areas: Expression, Quantitative Thinking, Social Studies, Natural Sciences, Literature, Vocabulary, and Sources of Information.

Nine scores were reported for the Seventh Edition of the ITED. These included a score for each of the seven tests, the composite over all seven tests, and a reading total score. The last was determined from the 118 items based on the reading selections in Test SS (36 items), Test NS (36 items) and Test L (46 items).

Level I was given to the ninth grade students of this study. Level I contained easier and less sophisticated exercises than Level II and was intended primarily for grades 9 and 10. Level II was given to the eleventh grade students of this study.

Each student received a standard score and Iowa and National percentile ranks.

Tests correlations for the most part ranged from .65 to .85. The level of the coefficient tended to vary directly with the concentration of verbal elements in the intelligence or aptitude measure. Using intercorrelation and reliability data from the equating sample for Forms X-7 and Y-7, the reliability of differences was computed for all pairs of subtests. The median coefficient equaled .60.

Both national and state norms for student scores and for school average achievement were provided with the ITED's. The national norms were established in a national standardization program conducted in April 1978. They were based on the scores of 30,085 students in 220 school districts. The Iowa norms are revised each year on the basis of data accumulated in the previous year's Fall Testing Program for Iowa high schools.

The Iowa Tests of Educational Development was a group test that required no special skills for administration. The person that administered the tests studied the directions well in advance of the testing, both to gain familiarity with the mechanics of giving the test and to practice a natural and meaningful speech pattern for reading the directions to the students.

The instructions given to the students for taking the tests were explicit and included a number of practice items for each subtest. Since separate answer sheets were used for the tests, the administrator read carefully the directions for filling them out.

A testing schedule was prepared. Ample time was provided for administrative details such as distributing and collecting test booklets and answer sheets, reading directions, doing the practice exercises, etc. The established time limits, based on item tryout groups, permitted all except the very slowest students to attempt all the items in their section of the test.

The details for the general arrangements and materials needed for testing were included in the tests' manuals for testing directors.

This study was interested in the relationship between one variable (learning style preference) and another (achievement). It was possible to determine the extent of this relationship through the use of the Pearson product-moment correlation. This coefficient was derived from the z scores of the two distributions to be correlated. The product-moment correlation coefficient of linear relationship, the strength and direction of a relationship between two variables was described by the value of r which ranges from a perfect relationship of positive or negative 1.00 to a nonexistent

relationship of zero. The strength of the correlation coefficient is usually interpreted according to the nearness of r to the perfect correlations of positive and negative 1.00. The statistical significance of the relationship and its confidence interval was determined through the use of statistical tables.

The following relationships of category variables were studied:

1. Auditory learning preference and Correctness of Expression achievement.
2. Auditory learning preference and Quantitative achievement.
3. Auditory learning preference and Vocabulary achievement.
4. Auditory learning preference and Reading achievement.
5. Visual learning preference and Correctness of Expression achievement.
6. Visual learning preference and Quantitative achievement.
7. Visual learning preference and Vocabulary achievement.
8. Visual learning preference and Reading achievement.
9. Tactile learning preference and Correctness of Expression achievement.
10. Tactile learning preference and Quantitative achievement.
11. Tactile learning preference and Vocabulary achievement.
12. Tactile learning preference and Reading achievement.
13. Kinesthetic learning preference and Correctness of Expression achievement.
14. Kinesthetic learning preference and Quantitative achievement.
15. Kinesthetic learning preference and Vocabulary achievement.
16. Kinesthetic learning preference and Reading achievement.

CHAPTER 4

Presentation of Data

As a first step toward determining the correlation among student learning style preference and performance on standardized achievement tests, a Pearson product moment correlation was computed for each of the sixteen selected pairs of learning style preference and standardized achievement test variables. The resulting correlations were then reviewed for their statistical significance at the .05 and .01 levels, according to table values.

The results of this correlational study were reported in Table 1. The table shows the correlational coefficient for the sixteen relationships studied. Each of the four selected student learning style preference variables from the Learning Styles Inventory were presented with the four selected achievement tests of the Iowa Tests of Educational Development and the resulting positive or negative value of r.

The following learning style category variables and achievement test category variables relationships were statistically significant, according to table values, at the .05 level:

1. Auditory learning style preference and Reading Total achievement (a positive value).
2. Visual learning style preference and Reading Total achievement (a positive value).
3. Tactile learning style preference and Correctness of Expression achievement (a negative value).

The following learning style category variable and achievement test category variable relationship was statistically significant, according to table values, at the .01 level:

1. Auditory learning style preference and Correctness of Expression achievement (a positive value).

When a correlation coefficient was statistically significant, it was meant that one may be reasonably confident that a true relationship existed between the variables correlated. If the correlation was significant at the 1 percent level, it could be interpreted as indicating that there was only one chance in a hundred that the correlation was due to chance errors in sampling.

Table 1

A Correlation of Learning Style Inventory Scores and Iowa Tests of Educational Development Scores for Titonka 9th and 11th Grade Students

LSI Variable	ITED Test	(N^r = 40)
Auditory	Reading Total	.3757[a]
Visual	Reading Total	.3256[a]
Tactile	Reading Total	-.2317
Kinesthetic	Reading Total	.1809
Auditory	Correctness of Expression	.5058[b]
Visual	Correctness of Expression	.2868
Tactile	Correctness of Expression	-.3357[a]
Kinesthetic	Correctness of Expression	.1225
Auditory	Quantitative Skills	.1849
Visual	Quantitative Skills	.0593
Tactile	Quantitative Skills	-.0882
Kinesthetic	Quantitative Skills	.2738
Auditory	General Vocabulary	.0807
Visual	General Vocabulary	.2094
Tactile	General Vocabulary	.2807
Kinesthetic	General Vocabulary	-.0919

[a]Correlation significant at the .05 level.
[b]Correlation significant at the .01 level.

CHAPTER 5

Summary, Conclusions, and Recommendations

The purpose of this study was to examine the relationships of selected assessed learning style preferences as determined by Rita and Kenneth Dunn's Learning Style Inventory and student achievement as determined by selected tests of the Iowa Tests of Educational Development. This study was conducted at Titonka Consolidated School, Titonka, Iowa, with forty ninth and eleventh grade students.

Learning style represents each person's biologically and experientially induced characteristics that either foster or inhibit achievement. The perceptual strengths of auditory, visual, tactile and kinesthetic student learning style preferences were each statistically correlated with four standardized tests of achievement of the Iowa Tests of Educational Development; Reading, Correctness of Expression, Quantitative Skills, and General Vocabulary.

This study concluded that there was, according to table values, a significant positive relationship between (1) auditory learning style preference and standardized achievement testing in Reading, (2) auditory learning style preference and standardized achievement testing in Correctness of Expression, and (3) visual learning style preference and standardized achievement testing in Reading.

There was, according to table values, a significant negative relationship between (1) tactile learning style preference and standardized achievement testing in Correctness of Expression.

No other significant relationships were determined for the sample

studied.

On the basis of this study, the following recommendations are offered:

1. Titonka Consolidated School's administration, in cooperation with the faculty, should continue to assess student learning styles and begin to plan and make use of in-service opportunities specifically designed to provide insight and further understanding of learning styles and their relationship with achievement.

2. This study should be replicated and expanded upon to include more learning style variables, as well as teacher learning style preferences, at Titonka Consolidated School on a yearly basis to see if similar findings result after teachers have had more opportunities to become familiar with how to accommodate various learning styles.

3. This study should be replicated in other school districts to determine whether similar findings are present.

4. All faculty and administrators at Titonka Consolidated School should be involved in the processes of diagnosis, prescription and evaluation of student learning style preferences and achievement.

5. All faculty and administrators at Titonka Consolidated School should work toward a more flexible learning environment in the school and provide learning style alternatives for students.

6. All faculty and administrators at Titonka Consolidated School should concentrate on better student advisement and guidance. The learning style preference concept is relatively value-fair and has great potential for course of study planning and career and personal counseling.

7. Educators should keep an open mind and be wary of generalizations in the area of student learning style. The research is incomplete, but

growing rapidly, and schools must take on the challenge presented by this concept.

Research into various learning styles is just beginning. Although there are undoubtedly many learning style variables that have not been thoroughly analyzed or even discovered yet, the challenge to educators is to proceed with what is known about how an individual learns best in an attempt to structure a quality education for each student.

It is probable that students who do well on standardized achievement tests are being taught in ways that best meet their learning preferences. More attention to the individual learning styles each student brings to the instructional setting and a willingness to prescribe educational strategies to meet the needs resulting from these learning styles should better enable students to develop their potential.

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